On Hypurgon Skeati, a New Genus and Species of Compound Ascidians.[1]

By

Igerna B. J. Sollas, B.Sc.Lond.,
Bathurst Student of Newnham College.

With Plates 34 and 35.

Among the marine sponges from the Malay Peninsula collected by Mr. R. Evans, of Oxford, at present Curator of the Government Museum in Georgetown, Demerara, and very kindly handed over to me by Dr. Harmer for description, there were included two specimens of the new genus of Synascida Didemnida, which I have endeavoured to describe below.

The locality named on the collector's label in the case of each of the two specimens is Pulau Bidang.

The association of the Tunicate with a sponge was merely fortuitous, and due solely to participation in the same surface of support.

The colony forms a thin sheet, little over 1 mm. in thickness, adherent to the substratum. The colour in spirit is a dirty yellowish brown.

The appearance of the colony when examined by reflected light under a low power of a binocular microscope is repre-

[1] I take the Greek ὑπουργός, and by lengthening the ό get ὑπουργών, meaning a place where things are made serviceable.

sented in Pl. 34, fig. 2. This external view shows at once the character to which the generic name alludes, namely, the presence in the test of numerous ovoid fæcal pellets. These are seen through the transparent substance of the test, and now appear of an opaque cream-white colour. Clusters of calcareous asters (fig. 3) mark out the oral siphons, since they make a conspicuous snow-white patch around each siphonal aperture. These white spots are visible also with the naked eye.

The arrangement of the ascidiozoids is irregular. A large number of them share the same atrium, the atria being shallow but extensive cavities with but few and small siphons. The siphons are not visible in surface view, but in section it is seen that their lips are formed of transparent test-tissue destitute of spicules.

The bulk of the common test, which consists of actual tunicin, is small, its substance being excavated by numerous oval spaces, in which the fæcal pellets lie. To reach this position the pellets must, after being ejected into the atrium, sink through the excessively thin epithelial wall of that cavity. The cellular elements in the test are of the usual types; bladder-cells are specially abundant near both upper and under surfaces, and round the oral siphons. Spicules occur in small numbers, chiefly aggregated round the oral siphons and in the neighbourhood of the branchial sac. They may be isolated or packed in dense clusters (Pl. 34, fig. 3). Finally the renal vesicles, described presently, are to be reckoned among the structures included in the test. The ascidiozoids, as is common among Didemnida, have a sharp constriction between the branchial region of the body and the abdomen.

The number of lobes round the oral siphons varies from four to six. The tentacles are twenty-four in number; twelve long ones alternate with twelve short. The branchial sac has four rows of five stigmata on each side. Connectives (Hancock; trabeculæ, Yves Delage) are absent. The dorsal languets are long and median in position. The subneural gland has a simple opening with a swollen lower lip (fig. 4, *d. t.*).

Through the narrow aperture of communication between the two regions of the body the œsophagus descends to open into the stomach, while the intestine passes upwards into the rectum, which lies above the constriction, so that the anal opening is close to the base of the branchial chamber.

The walls of the stomach are raised up round the termination of the œsophagus; or, in other words, the œsophagus has its opening deep in the cavity of the stomach; the terminal part of the œsophagus is richly ciliated. The intestine of a young bud is frequently found attached at both ends to the œsophagus, to which it owes its origin. When this is the case the thoracic portion of the same bud is to be seen lying in the test at the opposite side of the œsophagus. The budding is thus of the type known as pyloric (Giard), and found among Didemnidæ in the tribe Didemninæ (Y. Delage).

The walls of the stomach are smooth; seen en face from the outside they show a beautiful reticulum formed of the more deeply staining protoplasm which surrounds and connects the nuclei of the cells of the gastric epithelium.

The intestine as it leaves the stomach is richly ciliated; in passing thence to the anus its walls become continually thinner, the walls of the rectum being almost membranous. The anus has thickened lips. The alimentary canal is bathed by blood-sinuses along its whole course.

The heart in its pericardium runs more or less vertically between the upper and lower walls of the abdominal cavity. Its lower end abuts against and sends a large vessel into a prominence of the test, the sides of which are covered by a patch of specially large cells of the mantle which form the glandular part of the renal organ (*r. gl.*, figs. 5 and 7). The excreta of these glandular cells appear to be picked up by wandering cells—presumably corpuscles of the blood contained in neighbouring vessels or sinuses. These cells would then migrate into the test, carrying their burden with them.

Large numbers of vesicular cells containing concretions are to be found embedded on each of the above-mentioned prominences of the test, while in older kidneys there may be a relatively enormous rounded mass of such vesicles more deeply situated in the test substance (fig. 7, *k.*). Some such masses may be found in the basal layers of the test at a distance from the abdominal cavity of any zooid; these have evidently been left behind, the zooid to which they belonged having shifted upwards as the floor of the cloacal cavity was raised by the continual addition of fresh pellets.

Thus the excretory organs of Hypurgon agree with the simple type of excretory organ found in Botryllus, in that the urinary concretions are stored in the cavities of single vesicular cells; but apart from this particular they are of a type unlike any yet described (Dahlgrün, 'Archiv für mikr. Anat.,' vol. lviii, 1901) among Tunicates, and are far less simple than any known in other Synascida.

The reproductive organs lie in shallow depressions of the wall of the abdominal cavity (fig. 9). The testis is oval, and the vas deferens makes four or five turns of a spiral around it. The ovary has membranous walls, and contains a string of eggs of successive ages. I have not seen an oviduct.

Any mature ova that I have seen have sunk deep into the test, and so have come to lie in a great recess of the abdominal cavity (fig. 10), communicating with it by a narrow aperture. The material contains but one larva, which was developing in a completely closed cavity in the test (fig. 11). This may or may not be the normal course taken by the developing eggs. Eggs are not to be seen being sheltered by any other part of the organism than the test, though eggs of all ages were found in the ovaries.

The fæcal pellets, which contribute so largely to the formation of the test, show a very remarkable degree of coherence. If a piece of the colony be boiled in sulphuric acid, the residue consists of fæcal pellets which retain their form perfectly, and continue to do so even if the boiling be much prolonged. Even thin sections of pellets, isolated by boiling microtome sections of the colony in sulphuric acid, may still be mounted whole after this treatment. Boiling in aqua regia and boiling in fuming nitric acid are equally ineffectual in disintegrating the pellets; when these latter reagents are used the test naturally forms part of the residue, since they are not capable of dissolving tunicin.

When isolated by means of sulphuric acid the pellets have a black colour, due to the action of the acid on the organic matter contained in them. These blackened pellets may next be washed and calcined, and though raised repeatedly to cherry heat they still remain intact, and are now opaque white when examined by reflected light. Mounted in oil, or passed through oil into balsam, they become transparent. Calcined pellets dissolve completely in hydrofluoric acid. Prolonged boiling in a strong solution (nearly saturated) of caustic soda resulted in the dissolution of calcined pellets.

It seems, then, that the strong coherence of the pellets must be due either (1) solely to cohesion and adhesion between the foreign particles contained in them, or (2) to a deposition of silica between these particles. The siliceous nature of the greater part of this foreign matter makes it impossible to determine between these two alternatives. It naturally suggests itself that this property of coherence of the pellets is an adaptation to enable the animal to utilise waste organic matter with impunity. But it must be mentioned that the pellets are porous, taking stains readily both before the treatment described above, and also at every stage during it.

It is curious that the pellets are also highly fragile; they crumble at once under pressure of the cover-slip.

Melicerta tubes were boiled in acid for comparison: the form of the component pellets was lost almost immediately—as soon as the cementing substance between neighbouring pellets disappeared.

A parasitic crustacean was found in one ascidiozoid, occupying a large part of its branchial chamber. The body of the parasite is a mere sac filled with ova in an advanced state of segmentation. There appear to be six pairs of appendages belonging to the anterior region of the body, besides one foremost pair which serves as an organ of attachment, and is inserted into the tissues of the host.

The systematic position and diagnosis of the genus may be stated as follows:—Synascida Didemnida Didemnina, (Y. Delage). Colony thin; ascidiozoids with four rows of branchial slits and twenty-four tentacles; vas deferens spirally coiled round the testis; fæcal pellets included in the test, in which organ the renal vesicles are likewise contained.

In conclusion, it gives me much pleasure to take this opportunity of expressing my thanks to Mr. Graham Kerr for kind help and advice.

Literature consulted.

Herdman.—'Voyage of H.M.S. Challenger,' Tunicata ii.
Yves Delage.—'Zoologie concrète,' viii.
Dahlgrün, W.—'Archiv für nat. Mikr.,' lviii, 1901.
Giard.—'Arch. d. Z. expér.,' i, 1872.

EXPLANATION OF PLATES 34 & 35,

Illustrating Igerna B. J. Sollas's paper "On Hypurgon Skeati, a New Genus and Species of Compound Ascidians."

as. Calcareous spicule. *at.s.* Atrial siphon. *bd. c.* Blood-corpuscle. *bl. c.* Vesicular cell of test. *bl. s.* Blood-sinus. *d. l.* Dorsal languet. *d. t.* Dorsal tubercle. *end.* Endostyle. *f.* Fusiform cell. *g.* Nerve ganglion. *h.* Heart. *int.* Intestine. *l.* Larva. *n. tc.* Notochord. *œ.* Œsophagus. *ov.* Ova. *p.* Fæcal pellet. *p. c.* Pericardium. *rect.* Rectum. *r.* Renal organ. *r. gl.* Glandular cells of renal organ. *r. c.* Renal concretion. *st.* Stomach. *t.* Testis. *v. app.* Vasc. appendage. *v. d.* Vas deferens.

PLATE 34.

FIG. 1.—A piece of a colony of Hypurgon Skeati, slightly larger than natural size.

FIG. 2.—A portion of the surface of a colony seen under a binocular microscope. × 75.

FIG. 3.—Calcareous spicules from the test of Hypurgon Skeati. *a* and *b* from one colony; *c*, *e*, and *f* from a second. *f*, a cluster of spicules.

FIG. 4.—A vertical section through a part of a colony of Hypurgon Skeati, showing the branchial sac and parts of the abdominal cavity of one zooid (slightly reconstructed from neighbouring sections). × 80.

FIG. 5.—Vertical section of an abdominal cavity.

FIG. 6.—Diagrammatic reconstruction of a slice of a colony of Hypurgon Skeati, showing one zooid from the left side and one from the dorsal surface. Drawn as though it were transparent.

PLATE 35.

FIG. 7.—Section of a renal organ of Hypurgon Skeati which has been functioning long enough to form the considerable accumulation of concretions K.

FIG. 8.—Portion of the test of H. Skeati containing renal vesicles, more highly magnified.

FIG. 9.—Section of an abdominal cavity of zooid of H. Skeati, to show reproductive organs.

FIG. 10.—Section of a large ovum of H. Skeati in a recess of the abdominal cavity.

FIG. 11.—Section of a tailed larva of H. Skeati developing in a closed cavity in the test.